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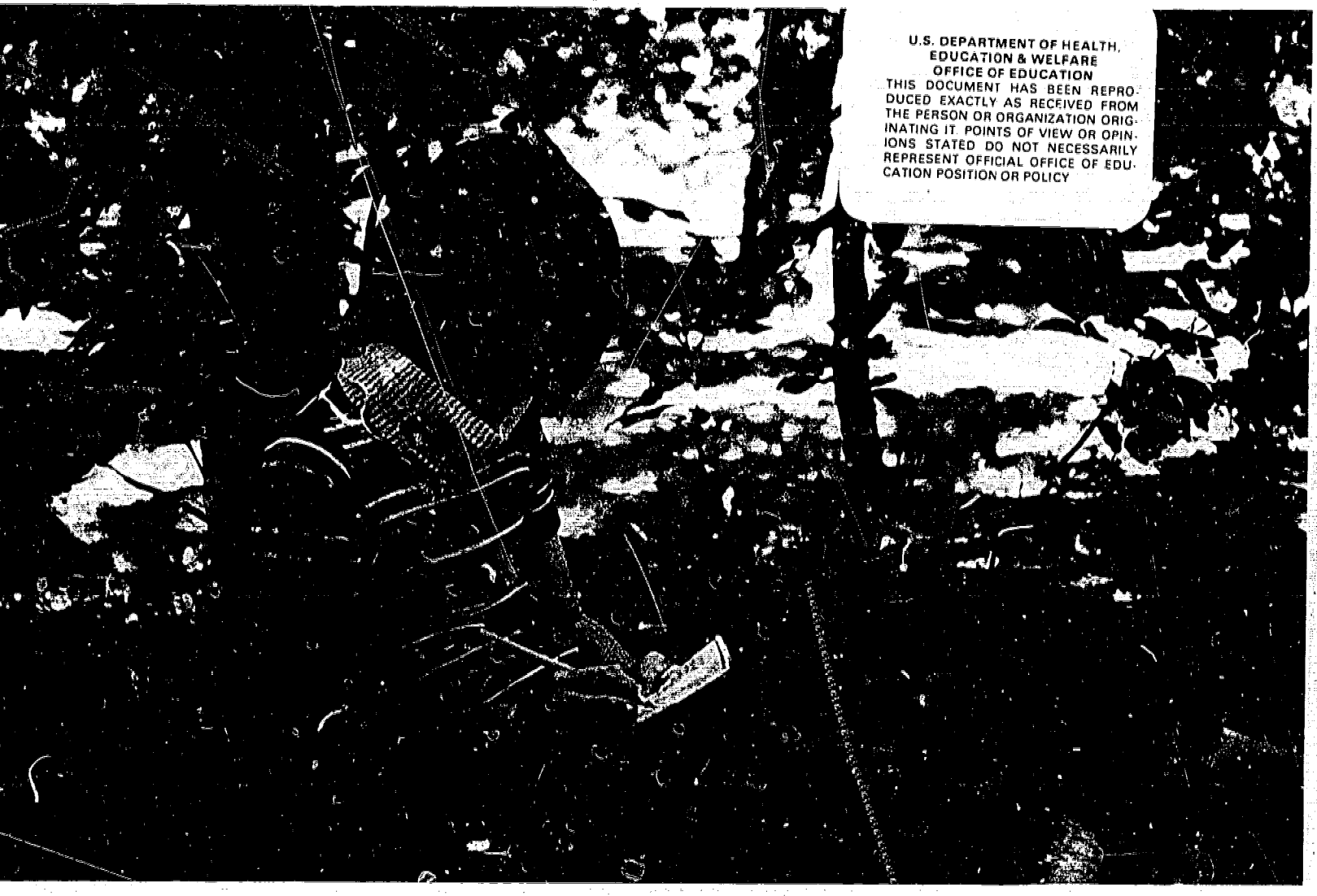
ABSTRACT

Contributions from a variety of sources are compiled in this manual to provide both students and teachers with environmental study activities. Several activities are suggested under each of the following topics: Ecology and Esthetics (emphasizing awareness); The Decision-Making Process (resource management problems); A Plea for an Alternative (assessing the impact of snowmobiles on the winter environment); Studying Gray Squirrel Habitat; A Deer Browse Story (indicating intricate plant-animal interrelationships); Snow Hydrology; Inspection of a Logging Project (how logging benefits the forest and wildlife); How to Build a Compost Pile (reducing the volume of solid waste); Environmental Action Activities (action projects); Nature Activities (to do on a hike or field trip); and Going Somewhere? (places to go and things to see outdoors). Appropriate charts, diagrams, and pictures are included. (BL)

# Learning To Live

## A MANUAL OF ENVIRONMENTAL EDUCATION ACTIVITIES



# LEARNING TO LIVE

*A Manual of Environmental Education Activities*

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PREPARED BY:

The Minnesota Department of Natural Resources
Bureau of Information and Education

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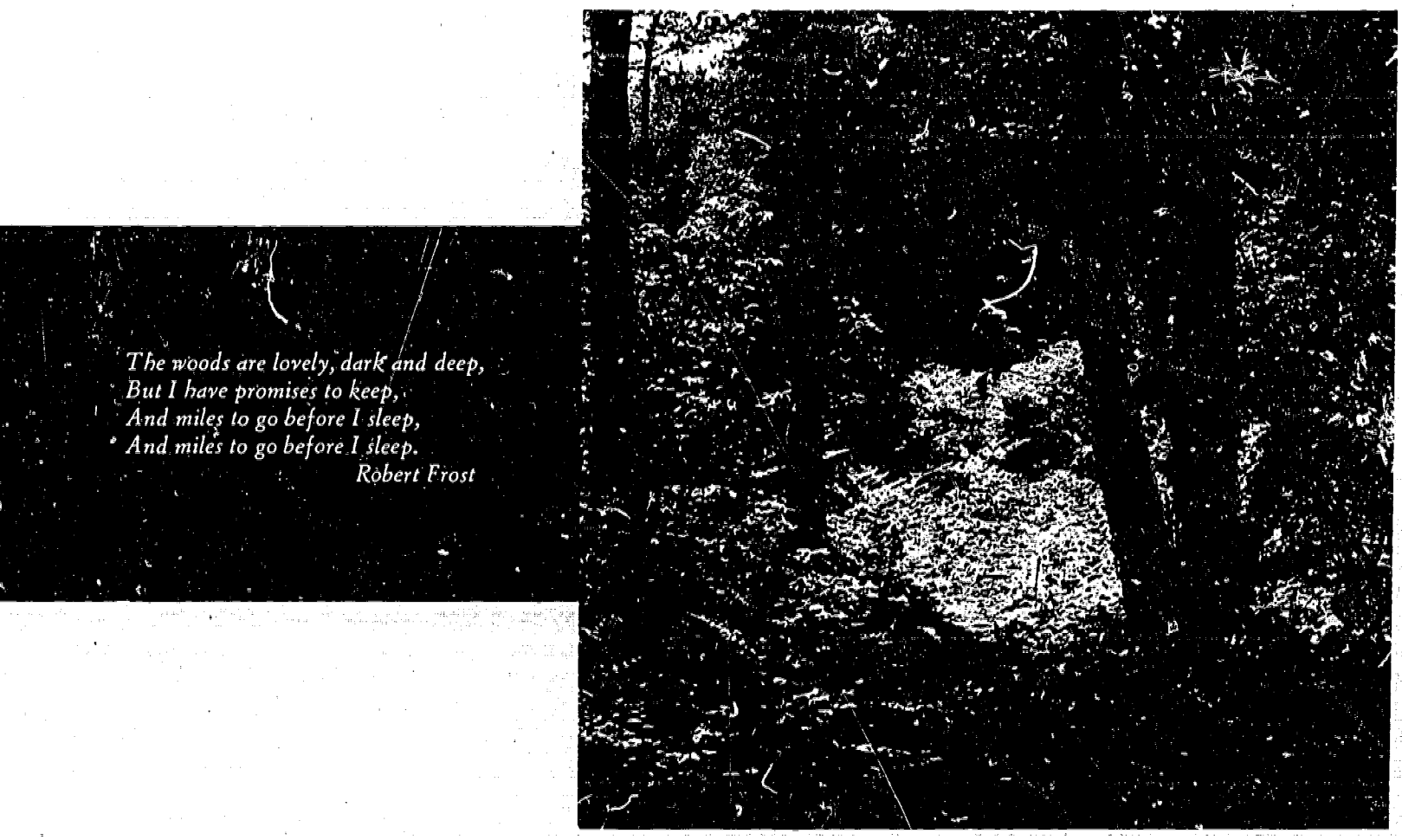
Environmental Sciences Foundation, Inc.
Hennepin County Park Reserve District
Minnesota Department of Education
Minneapolis School System
Bemidji State College
U.S. Forest Service

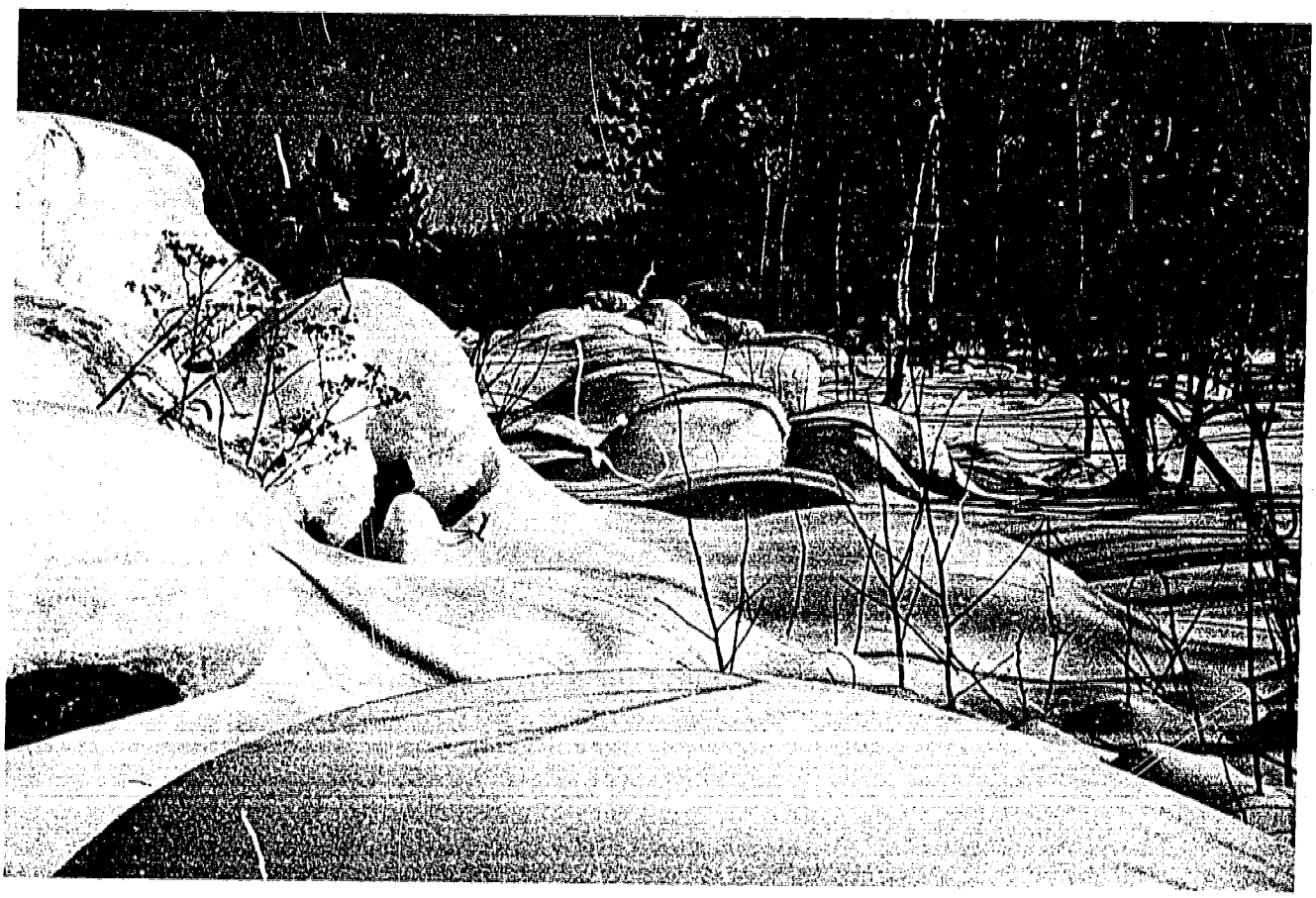


*The woods are lovely, dark and deep,*
*But I have promises to keep,*
*And miles to go before I sleep,*
*And miles to go before I sleep.*

*Robert Frost*

# ECOLOGY and ESTHETICS

By Wallace Kennedy
*Urban Arts Program—Minneapolis School System*



Overcoming our environmental crisis depends on AWARENESS, not only by students but adults as well.

Ecological concern reflects more than an informed, problem solving, logical awareness. Concern that generates action is aroused by those subjective feelings we get from what we see, hear, smell, touch and do. When we can communicate those feelings, we arouse the concern of others, and together we can take better care of this spaceship called Earth.

The following activities permit esthetic expression to grow from activities with nature. They fit all ages.

### Expression From Moving Across Snow

The purpose is to express through writing, drawing or snow sculpture the feelings resulting from a snowshoe hike, a cross-country ski tour, or a snowmobile ride.

Spend an hour or more moving through the woods on snowshoes, skis or snowmobile, preferably limiting verbal communication during that time. Then, calling on your memory, record what you sensed as you moved across the snow. Use snow sculpture, draw with crayons, or write to express all you felt. After finishing your expression, give it to others with an introduction that helps them get the message.

### Building And Using A Snow Cave

Working in teams of four to six, build a snow cave that expresses "organic architecture" and provides territorial function inside. If you have to help nature make the drift large enough for a snow cave, so much the better. Set up barriers like snow fences that will shape the drift and give you the size cave you need.

Plan the cave together as you make it. Shovels help, but hands and feet dig and move snow adequately. As snow is removed, pile it outside to fit contours already shaped by wind. Be sure the entry is at a 90 degree angle to the length of the cave. Chances of a cave-in are very slight. However, it is a good idea for one person to stand ready, shovel in hand, just in case.

Shape the interior for the function of the persons who will use it. Keep sleeping ledges high enough to prevent overheating. Hip width plus one foot is the rule if you want to keep from melting your own ceiling. Circulation holes through ceiling and walls help prevent melting. Distribute the interior territory, shape it to its function, and move in.

Outside your entry, fly your pennant or shape your coat of arms to indicate what clan or tribe has built this cave. The longer you inhabit your cave, the more you will learn about winter weather.

### Planning A School Site Sanctuary

Turn a portion of your local school ground into an ecosystem sanctuary to be developed and maintained by students and teachers.

First, outline a communication process that enables your team to persuade "others" that a school site sanctuary is important.

Next, locate your site as most appropriate for the richest, most durable ecosystem sanctuary possible.

Develop a calendar compatible with nature that requires development of the sanctuary with the total ecosystem in mind. For instance, if your land is flat, everyone brings a bucket of dirt every day to build a hill of many soils, many seeds, many inhabitants.

Protect and teach respect for your life sanctuary without depending on fences and guards.

Perpetuate the sanctuary as evidence of full life close by. The planning portion makes a great workshop activity, especially when stimulated by a wilderness setting.

*Resource Management And . . .*

# THE DECISION-MAKING PROCESS

On-Site examination and discussion are necessary in group decision-making.

**Presenting students with the opportunity to work with experts and make their own decisions offers valuable insight into the complexities of our resource management problems.**

By Robert L. Joens
*U.S. Forest Service*

The job of today's resource manager is more complex than ever. To make matters worse, his work is often controversial, simply because the public does not understand the intricate complexities involved in making resource management decisions.

Because his decisions affect so many people, he must dig deeply to uncover all facts, seek the advice of countless others, digest reams of data and finally, arrive at a suitable decision.

The purpose of this activity is to provide students with the opportunity to work with resource managers on everyday problems and encourage them to reach their own decisions.

Students can work with resource managers on problems of varying intensity. Such a problem might be: Whether or not to cut the beautiful oak tree in the school yard to make room for a new parking lot.

### Procedure For Activity

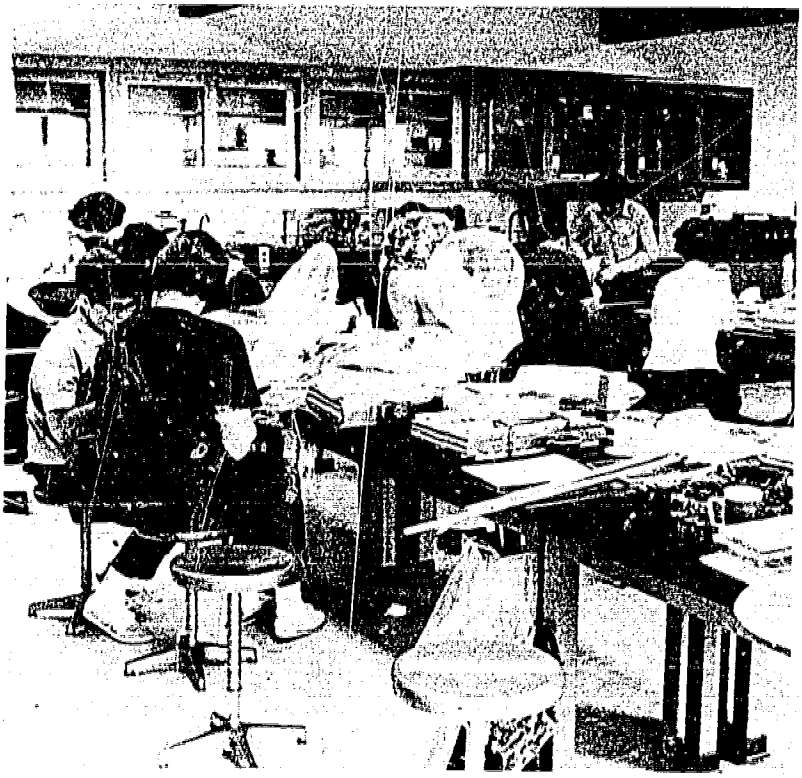
The teacher and class must decide what problem to research, how far they can travel and how much time to spend on the activity. The topic could be something local or a field trip to a nearby site. If the class is unable to select an activity, contact a resource manager for advice.

Most managers welcome the opportunity to work with teachers and students but remember, they have a job to do — so don't make a pest of yourself. Offer your assistance. If you have a project in mind, discuss it with him. If not, tell the resource expert what you are trying to accomplish and let him suggest some projects. Let the class decide what to pursue. Set a goal of 100 percent commitment from the class.

Resource managers who may be available include:

City managers or city foresters
County and state foresters
Fish or game managers
District rangers of the U.S. Forest Service
Soil Conservationists with Soil Conservation Service
County Extension Agents
Managers of local parks and forests
Directors of environmental education parks and sanctuaries

Most resource managers enjoy working with eager, young minds and welcome comments even though final decision on the problem may have been made.



Classroom or lab preparation is often necessary before visiting resource manager in the field.

Some sample problems:

1. Should we use salt on streets for snow removal?
2. What can be done about Dutch Elm disease in our town?
3. How to manage local parks for aesthetics or for a large number of people.
4. Are there solid waste disposal or sewage treatment problems in your area?
5. What types of developments should be allowed along our lakeshores?
6. Should timber be harvested in local parks and forest preserves?
7. Should new roads be constructed through existing wooded areas?

Your first step is to become informed about the problem before meeting with the resource manager. Some type of classroom preparation is often necessary. This may entail a brief description of the activity by the teacher, some study assignments to obtain background information, a movie, slide show or lecture.

If background material is needed to better evaluate the problem, the resource manager can often suggest references. It is possible that handout material or a resumé of the problem can be obtained through him.

At this stage, the teacher must be the judge as to how involved the class should become with the project.

Once the contacts and preparation are completed, it is time for the class to meet the resource manager. This should be done on a field trip to the area where the problem can be discussed and studied first hand. The resource manager will normally handle this part of the activity. It will probably consist of discussion, on-the-ground examination and presentation of facts. The manager should plan the activity so the students will be able to actively participate in the program.

After the facts are brought out and discussed, the class should arrive at a group decision. This may be done during the field trip or back in the classroom.

The entire class certainly will not agree on the same solution but rather than take a majority rule vote on the issue, try to arrive at a decision that is acceptable to all parties. This is often what a resource manager must do in his decision making.

Next, present your class decision to the resource manager. Though his decision for the problem may already be made, the manager may still consider your position. Resource managers welcome comments, and by dealing with a school class, it may open up a new source of public involvement.

The amount of follow-up depends on the time the class is willing to spend on their problem area. It could end with the class decision or it could involve writing their representatives and Congressmen to make their positions known.

If requested, the resource manager will keep the class posted on future developments or on the final outcome of the project.

**Activities to assess the impact of the snowmobile on the winter environment — for Junior and Senior High students.**

# A PLEA FOR AN ALTERNATIVE

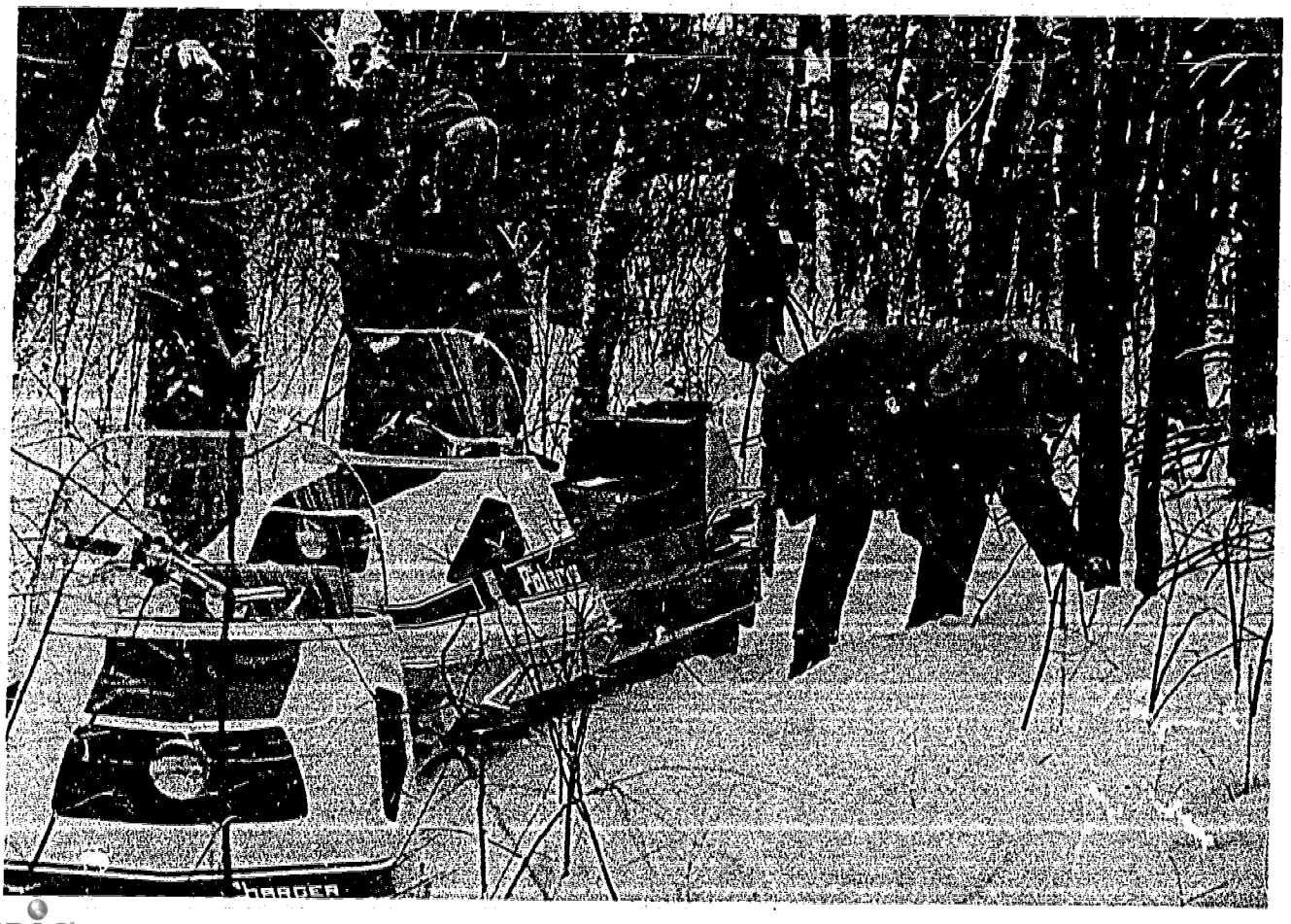
Prepared by the Environmental Science Center

We have loosed a mechanical creature upon our winter landscape which weighs from 215 to 650 pounds and has the strength of from nine to eighty horses.

This mechanical creature is changing — a look at the near future sees him with a larger and heavier stature and even more power. His evolution is also freeing him from his restriction to snow-covered areas. He will soon be found year-round with wheel attachments for easy conversion to dry land use.

The following studies are designed to reveal the environmental impact of this creature — the snowmobile.

Select trails in an easily accessible area. Some effort should be made to categorize the study trails with respect to age or use. Differentiation might be simply



"heavily trafficked," "lightly trafficked," and "one time use." The "one time use" trail should be made by the investigators and used for comparison purposes.

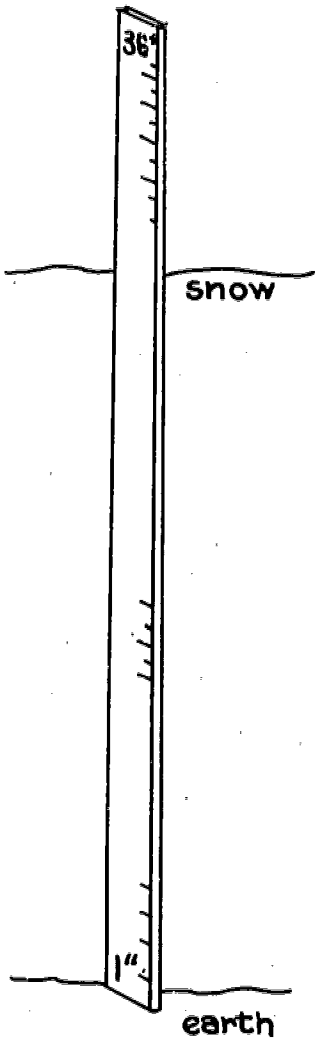
A more controlled study might involve setting up a monitoring system to establish an average number of snowmobile uses per day. If a counting device can't be constructed or obtained, a few hours spent actually counting machines at various times during the day could be completed and per day data estimated from these sample counts.

### Snow Compaction Study

1. Depth of Snow — Snow depth on snowmobile trails compared with depth on untracked snow can be used as an indicator of snow compaction. A yard stick or, even better, a sharpened lath marked in intervals will suffice as a measuring device. Compute average of several measurements; consider differences in snow compaction at points on the trail where the machine's power is increased or decreased, i.e., corners and hills.

2. Water Content — Compacted snow will contain more water per unit volume than its non-compacted neighbor. To determine water content, take snow samples in a certain volume size container, allow it to melt and compare quantities of water.

Use a soup can to gather snow samples. A ruler is used to slice snow evenly along lower rim of can.




Yard stick or sharpened lath marked in intervals can serve as a device for measuring snow depth.

Soup cans cut out at both ends work well for taking samples. Shove the can into the snow until the snow is level with the rim of the can. A ruler or thin piece of wood can be used to slice along the lower rim.

3. Insulation — As snow becomes more and more compacted, its ability to insulate is altered. Fairly sensitive thermometers should be used for their investigation. Take temperature reading at various levels in the snow, i.e., surface, 1/3 depth, 2/3 depth and ground surface. If you have a soil auger, continue your readings as far as possible into the soil. Can you determine frost depth in the soil?

Always compare trail readings with readings taken away from the trail. Always record air temperature. Again, variability in the trail might be studied; i.e., hills, curves, etc.

### Biotic Impact

1. Woody Vegetation — The quantity and quality of vegetation damage can be investigated. Establish percentage of damaged branches for bushes and young trees in the trail. Qualify this data by collecting and interpreting it in terms of type of damage done, i.e., skinned bark, branch broken off, branch cracked, etc.

2. Leaf Litter — The effect on leaf litter is approached from two directions: (a) what is the physical character of the litter, and (b) what is its biotic potential. Leaf litter samples must be gathered from several points along

the trail and compared with litter gathered from adjacent noncompacted points. Take samples that include soil material.

The physical character observations might include: "Is the litter frozen in a clump or loose and light? Are there ice crystals in the litter? Does the trail sample differ from the adjacent sample in leaf particle size?"

Samples should be taken back to the classroom and kept moist in a container in the sunlight. Sort through the litter periodically. Do any insects, spiders, sow bugs, worms and snails appear? Do any seedlings sprout? If so, are there any differences between the quantity or type of living material between the samples?

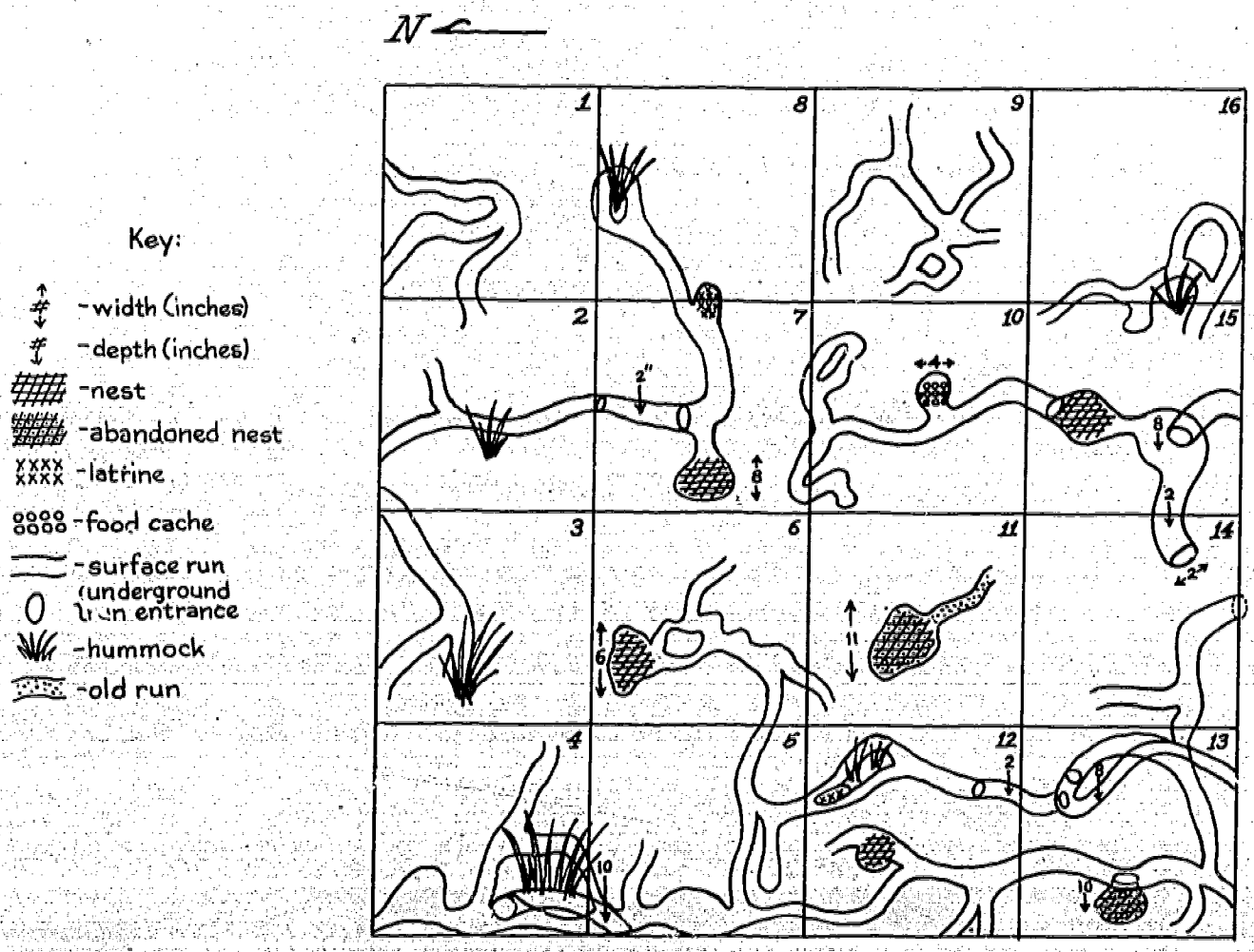
3. Small Mammal Impact — During certain spring thaw conditions field mice runways are readily visible. By roping off an area, a simple grid map can be made of these surface runways and their contents. It is a fun and fascinating activity.

Students should have trowels or sticks for lifting off the snow crust and plastic bags for collecting seats or other interesting things that might be present in nests, runways or storage chambers. Students must work carefully and slowly from one section of a plot to the next.

As a comparison, locate a similar type of field which has been heavily used by snowmobiles. Try to conduct the same investigation and compare results.

After studies such as these, young people will still use the snowmobile. The excitement, thrill and human companionship of snowmobiling will still be there. However, they might use them with more caution. They might also be more receptive to future snowmobile regulations designed to protect the environment.

# GRID MAP



*This enlightening activity can be adapted for use with many other animals than squirrels.*

Catching a glimpse of Gray Squirrels can prove difficult, but their presence can be determined simply by evaluating an area for available habitat.

# STUDYING GRAY SQUIRREL HABITAT

By Jim Gilbert and Molly Redmond
*Nature Centers — Henn. Co. Park Reserve District*

One of the animals most commonly found in the city and the country is the Gray Squirrel. Because of its adaptability and widespread distribution, the squirrel makes an excellent subject for habitat study.

The purpose of this activity is to evaluate an area to determine if it is a good place for Gray Squirrels to live. Some of the things to consider are the type and amount of food, availability of shelter and freedom from natural enemies.

This activity can be adapted for use in grades 4 through 12. For younger grades, the data sheet on page 2 may be made less complex. This activity can also be adapted for use with many other animals.

Have the students choose another study animal, discover its specific food, shelter, protection, etc. and see what other special needs it might have. (Remember, there are other types of squirrels; fox, red, etc., whose needs and habitats are somewhat different from those of the Gray).

**Pre-activity**

Lead into this activity by discussing habitats, communities and transects.

An animal's habitat is the area in which all his needs for living are provided — food, water, air, shelter, protection, reproduction, space, etc. This may be a very large or a very small area, depending on the animal and its specific needs.

A community is an area where plants and animals live together and depend on each other — a forest, stream, vacant lot. If something is removed from a community, its loss will affect the other members.

A transect is a sample taken along a line. In many cases, a transect involves collecting samples at given intervals (unbiases) along a line. In this case nothing is collected, and observations are made along the entire line, and 50 feet to either side.

Have the group research the needs of the animal they intend to study.

If it is winter, do a short tracking unit: Tracks are one of the best ways of discovering what animals are in an area.

Equipment: 16 stakes for transect line, clipboards, data sheets and pencils.

## Habitat Requirements for Gray Squirrels

### FOOD

Tree seeds and other wild fruits (acorns, basswood seeds, ironwood seeds, etc.)
Tree buds (when the buds of elm, oak, maple, etc. are swelling in the spring they are especially appealing).
Tree bark (red squirrels will even eat parts of the prickly gooseberry).
Insects
Bird eggs
Fungi
Human handouts (feeders, corn cribs and many agricultural crops).

*Note — squirrels can live without open water. One large acorn may contain up to eight drops of water.

### SHELTER

Squirrels need trees or other elevated places, as they don't live in ground holes.
Hollow trees (look for holes two inches or more in diameter).
Leaf nests
Human handouts (attics, wood duck houses, etc).

### REPRODUCTIVE NEEDS

Another squirrel
Secure den trees (if there aren't enough to go around, squirrels will build leaf nests to use as cradles).

### PROTECTION FACTORS

Protection will keep squirrels from being preyed on. Foxes, owls, large hawks, weasels, mink, raccoons, dogs, cats, humans and man's machines will kill squirrels. Check the area for tracks and other signs of these killers.
Things to look for when deciding if the area being considered is a low or high risk area:
A. Are there aerial routes? If the trees have touching tops squirrels can escape.
B. Are there lots of tree holes?
C. Good visibility?

### NOT TOO MUCH COMPETITION

For food. Competitors are turkeys, wood ducks, chickadees, other birds, chipmunks, deer, mice, raccoons and people.
For shelter: Wood ducks, screech owls, chipmunks, raccoons, and a few other animals will nest in the same places as squirrels.

### Activity

a. Organize students in teams of two. Set up a transect line with markers at given intervals (about 50 paces). The group should be involved in setting up the line. Unless land forms or other problems (private property, busy roads) prevent it, the transect line should be straight. Good contrasts can be made by running lines in different types of areas (marsh, woods, brush).
b. Each team has a list of the specific requirements of squirrels, a data sheet, a pencil and a clipboard.
c. Each team is asked to rate the area for each of five factors. Assign the highest rating to the best situation. The reproductive needs category was rather arbitrarily judged. Squirrel signs (tracks) are an indicator of many or few squirrels in the area. Competition rates high (scored low, one or two) if there are many signs of other animals which use the same shelter areas or food as squirrels.

The last blank asks for a brief summary of the area in words, rather than numbers. Depending on the age range of the group, this can elicit comments from "happy squirrels" to "disaster area" to "too many fox tracks" to "high stress conditions."

### Post-Trip Discussion and Activities

a. Have groups compare their ratings of the same and different areas.
b. Do another transect with another animal.
c. Set up transect lines through different types of communities.
d. Set up a "people transect." What do people in a community need? How large an area does it take to supply them? What is different about the way people fill their needs? (Community solutions, sewers, water lines, transportation, etc.).

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5 Excellent area for squirrels
4 Good area for squirrels
3 OK area for squirrels
2 Poor area for squirrels
1 Very poor area for squirrels

NAME_____

## DATA SHEET

### Limiting Factors That Affect a Squirrel's Life

| Observe the area about 50 feet on each side of the trail Consider the whole distance from stake 1-2 | Area Number | Food | Shelter | Reproductive Needs | Protection | Competition | Your conclusions for each area. Use back, too. |
|---|---|---|---|---|---|---|---|
| | 1 | | | | | | |
| Stake 2-3 | 2 | | | | | | |
| Stake 3-4 | 3 | | | | | | |
| Stake 4-5 | 4 | | | | | | |
| Stake 5-6 | 5 | | | | | | |
| Stake 6-7 | 6 | | | | | | |
| Stake 7-8 | 7 | | | | | | |
| Stake 8-9 | 8 | | | | | | |
| Stake 9-10 | 9 | | | | | | |
| Stake 10-11 | 10 | | | | | | |
| Stake 11-12 | 11 | | | | | | |
| Stake 12-13 | 12 | | | | | | |
| Stake 13-14 | 13 | | | | | | |
| Stake 14-15 | 14 | | | | | | |
| Stake 15-16 | 15 | | | | | | |
| Example | 71 | 1 | 1 | 2 | 1 | 1 | Marsh area—this would be a disaster area for squirrels |

# A DEER BROWSE STUDY

This exercise unravels some of the intricate plant-animal interrelationships of the Whitetailed Deer in his winter environ.

By Gerald L. Jensen
Hyland Lake Park Reserve
and
Dick Carlson
Division of Game and Fish, DNR

Winter is a time of hardship for our Whitetailed Deer. Deep snowdrifts make it difficult for deer to move about in their constant quest for food, much of which lies buried under a heavy blanket of snow.

To survive our harsh winters, deer usually remain in a relatively small area where they establish a network of trails in the snow. In this area, called a "yard," the food deer eat must be within reach from the trails. If food is not accessible, deer must travel to new food areas or they will starve.

The tender tips of twigs are usually the deer's primary diet. Occasionally, he will eat acorns and different types of green vegetation if not buried too deeply.

The purpose of this activity, however, is to sample only those twigs that are in reach of deer and determine what plant types are eaten most.

Material Required

Four 20-inch sticks, plastic bags, hedge clipper or knife per group of students. Fruit and twig key to woody plants. Snowshoes if survey is conducted during winter (this survey may also be performed in early spring).

**Performing The Survey**

Move the group into a wooded area where one student randomly tosses a stick to mark the center of your first plot. Next, place the ends of the three other sticks against one end of the sampling stick all at right angles to each other.

Imagine a circle 40 inches in diameter which touches the ends of all four sticks. Take a six-inch sample of every branch in the plot. Be sure to include those

Favorite "cafeterias" for deer are stumps where succulent new growth often sprouts.

branches that enter the imaginary walls of your circle extending upward to a height of six feet or as high as a student can reach.

Other plots should be taken about 10 paces apart from each other in a straight line. Remember the number of plots sampled. At least 50 should be taken.

After a designated number of plots have been taken, each group should sort out its clippings. Place the similar kinds of plants together. You may not know the names of the plants but by looking closely you can distinguish some differences. This process allows each group to get a visual picture of the different kinds of plants and relative amounts of each.

All groups of similar plants should be checked to see if any of the buds were eaten off by deer. The bud ends will not be cut off sharply but will be frayed.

**Information That Can Be Obtained:**

1. Separate those types of plants that deer have eaten. Place them in order by the amount eaten. Determine what ratio of actual brush present is eaten by deer. It should be quite a small ratio.

2. Calculate the number of stems on one acre of land or one square mile. A 20-inch radius circle equals 1/5000 acre.

$$\text{Plants per acre} = \frac{\text{Total plants collected} \times 5000}{\text{Number of plots taken}}$$

Also, calculate this for each species of plant sampled.

3. To calculate the amount of food available to deer: Cut the buds off each twig from all those plant types which showed evidence of deer browsing. Back in the classroom, weigh your total sample of buds.

Determine the number of plants of each species per square mile by multiplying the "plants per acre" by 640. Then, multiply the result by the number of pounds to give the amount of food available. An average deer eats about five pounds per day. How many deer can live in the square mile where you sampled? Remember there is about five months in the winter season. Do deer eat other things in the area sampled? Corn, alfalfa or acorns?

**Comments:**

Plants that cannot be identified should be keyed by using a twig guide. Once the plants have been identified, future sampling can be done without collecting plants. The students should not worry about cutting brush, however, because it produces new sprouts for deer to eat next year.

While performing the survey the students should look for pellets left by deer and other animals, especially rabbits. Similar experiments could be carried out for rabbits by picking out those stems where rabbits have chewed the bark near the ground level.

See if the student observer can determine the depth of the snow by measuring where the rabbits have eaten on the twigs.

These exercises are examples of how we can uncover plant and animal interrelationships in the winter out-of-doors. The method is easy and yields plenty of data, experience and materials to uncover many mysteries. However, new questions will no doubt evolve from this activity and these may be answered only through future investigations.

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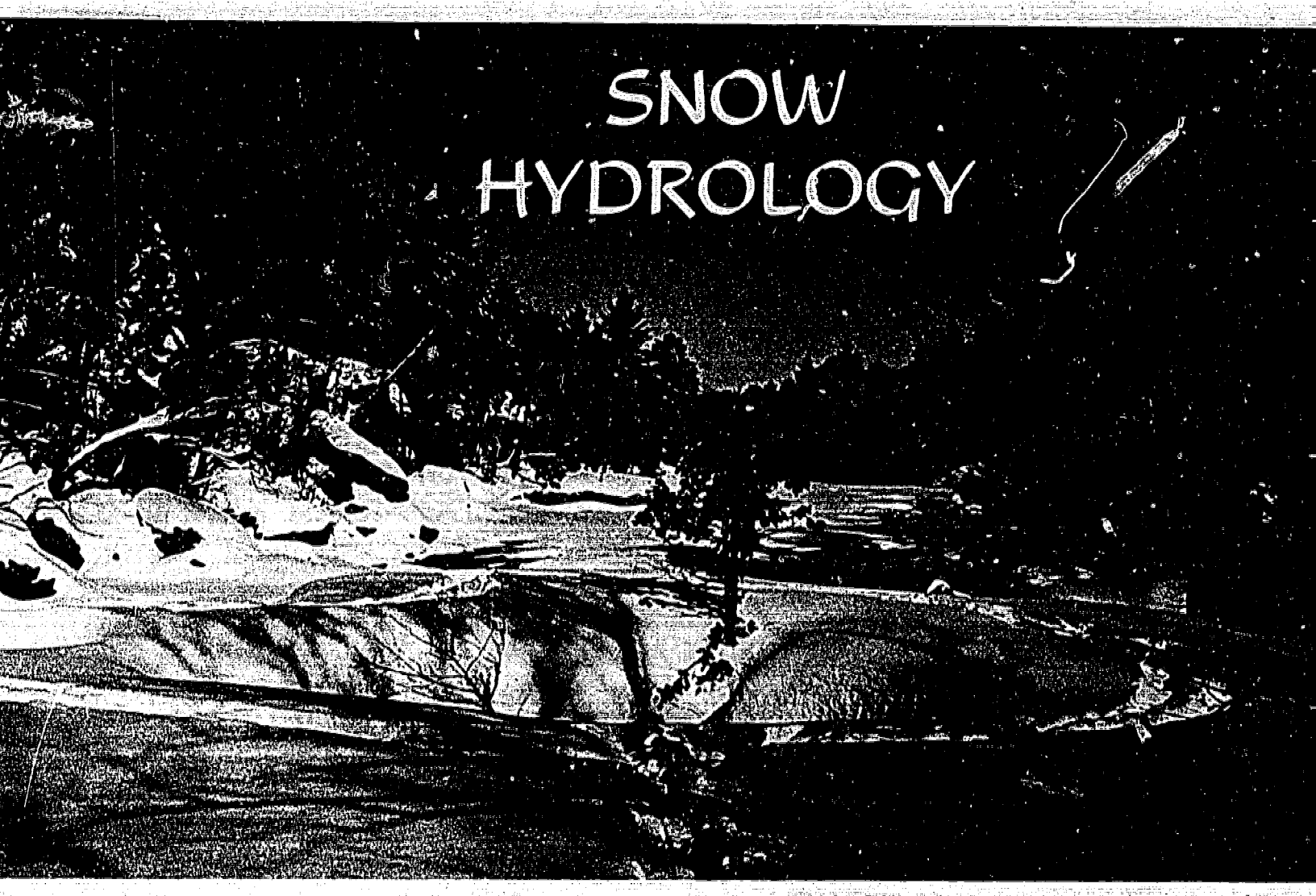


# SNOW HYDROLOGY

By John Osborne
*U.S. Forest Service*

For many Minnesotans, winter is the time to stay inside. But for some, it is a time for discovery — a time to unravel the mysteries of the winter environment.

By using some hand-made equipment and a little gray matter, a wealth of interesting information can be gathered about snow including average depth, water equivalent and other phenomenon such as temperature and layering.

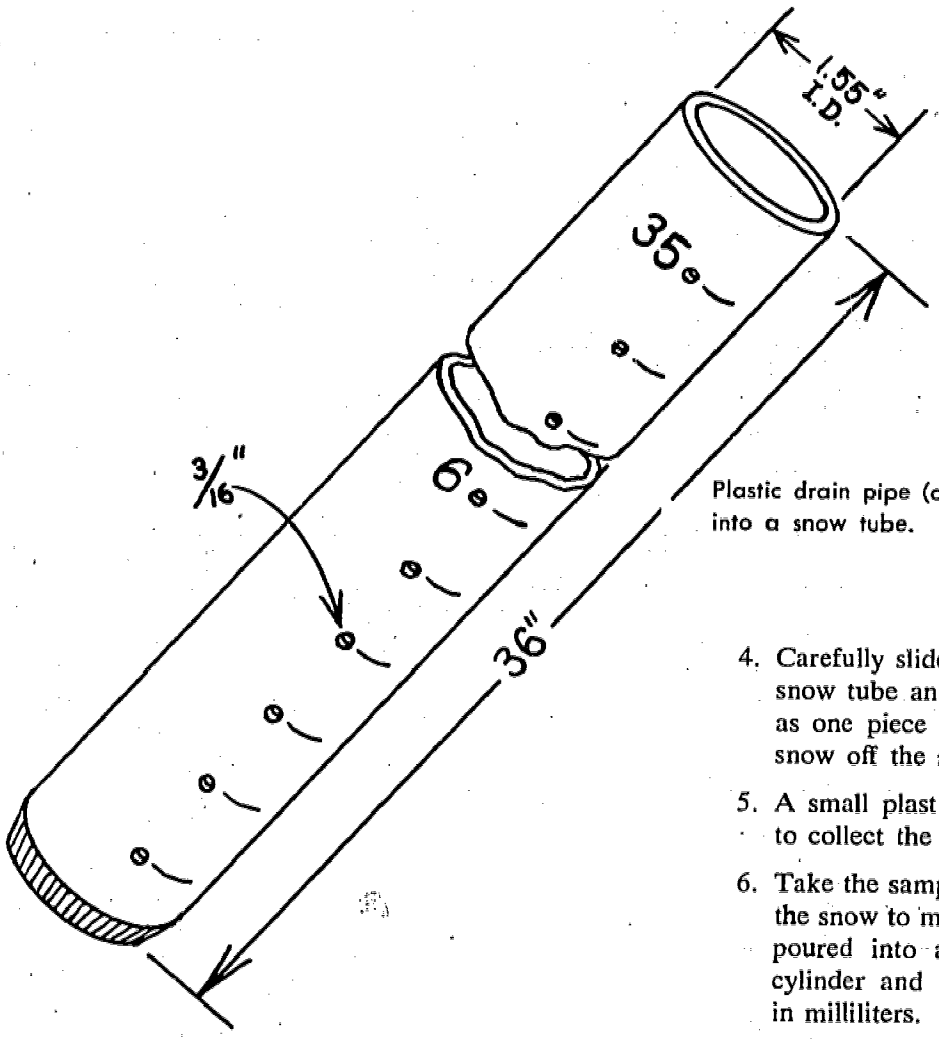
Snow depth and water equivalent can be obtained with a simple, inexpensive snow tube. Acquire a 3-foot by 1-7/8 inch piece of drain pipe (cost about one dollar), with one end of the tube having beveled edges. Mark off the outside of the tube in inches with a felt tip pen and drill 3/16-inch holes at each graduation mark.

Snow depth and water equivalent vary throughout the winter season and also vary by location of the snow pack. Different types of cover such as a dense pine stand versus a south-facing slope, or flat ground versus a steep slope all affect these two snow pack parameters.

To obtain a snow depth measurement, drive the tube sharply into the snow pack and read the actual snow depth on the tube.

To obtain a water equivalent measurement in inches of water (the same unit of measurement used for rain),

Because we know so little about snow, it serves as a fascinating and intriguing subject to study.




Plastic drain pipe (cost about $1) can be easily converted into a snow tube.

a more complex procedure is required. Steps to follow include:

1. Calculate the volume contained in one inch of the tube. Example: A tube having an inside diameter of 1.55 inches would have a volume of 1.89 cubic inches or 30.9 milliliters. (Vol. = $\pi r^2 h$)
2. In the field, after the snow depth measurement is taken, carefully shovel the snow away from one side of the snow tube.
3. Compare the snow depth inside the tube, through the 3/16 inch holes, with the outside snow depth. If the two depths are about the same, you have a good sample. The inside snow core will always be compressed. How much it compresses depends on the nature of the snow pack. Experience is your best guide as to whether or not you have a good sample.
4. Carefully slide the shovel under the end of the snow tube and raise the shovel and snow tube as one piece to the surface. Brush any excess snow off the shovel.
5. A small plastic garbage bag can then be used to collect the snow contained in the tube.
6. Take the sample bag to a warm area and allow the snow to melt. The melted snow can then be poured into a standard laboratory graduated cylinder and the volume of water determined in milliliters.
7. Divide the results of step 6 by results of step 1. This will give you the water equivalent in inches.

Once you have a hole dug in the snow pack, this is an excellent time to observe other snow pack phenomena such as temperature and layering.

The simplest exercise is to observe snow pack differences between an open area and a dense swamp conifer stand. Take at least five samples in each area. The differences observed have important implications in the winter behavior of many animals.

The differences may also suggest methods to manipulate the forest cover to increase water yields and reduce spring flooding. Identification of these differences and their effect can lend important insights to our environment.

**Bibliography**

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*Snow Hydrology*, Corps of Engineers, U.S. Army, Portland, Oregon, 1956.

**Logging provides food for wildlife and also benefits the forest. But how?**

# INSPECTION of a LOGGING PROJECT

By Dennis Ingvaldson
*Division of Lands and Forestry, DNR*

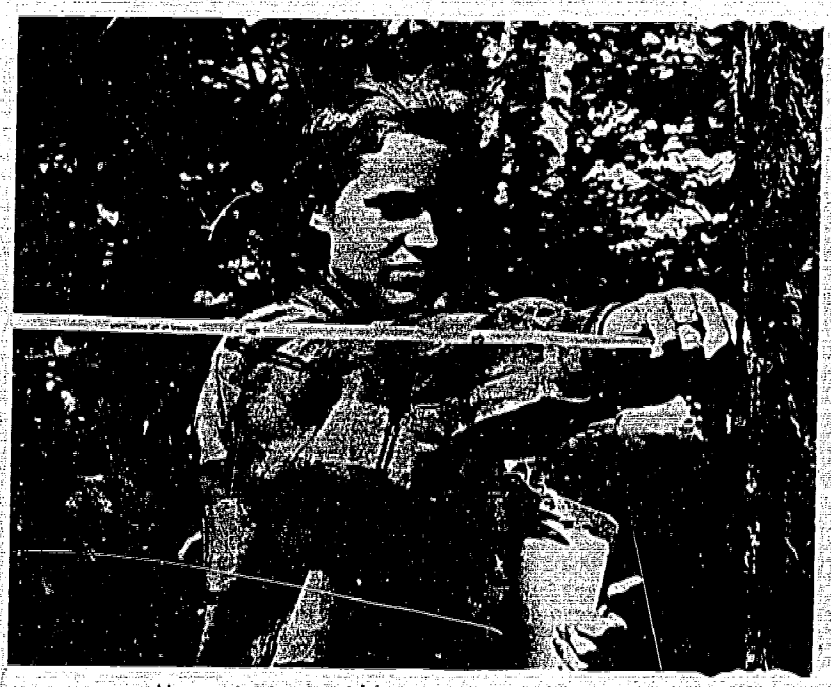
Purpose of this activity is to demonstrate by direct contact some aspects of forest management, logging practices and the effect of logging on wildlife. Students at the kindergarten through sixth grade levels can receive some benefit from this exercise, but it would be more appropriate for grades seven through twelve.

### Methods of Logging

What type of logging is taking place on your area? Following are the different methods:

*Clearcutting*

All trees on the site are cut. Reasons: Intolerant species must have full sunlight to reproduce. The re-



Measuring tree width.

Counting rings.

mainder of the trees of some species would blow over if the forest were just thinned. Many species grow in even-aged stands, and all trees mature about the same time. It is frequently not economical for the logger to make a partial cut.

*Thinning*

Some of the trees are removed from an area to allow release of the remaining trees for better growth. This is done primarily in plantations or in even-aged, natural forests.

*Partial Cutting*

Trees on a given area are harvested at different times. Often, stands (areas of trees) have trees of varying ages which mature at different times and thus, cannot be harvested simultaneously. It may be desirable to remove defective or dying trees and any less desirable species to upgrade the stand. In the interests of aesthetics, partial cutting may be preferable to clear-cutting at times.

*Reproduction*

What species is replacing the old trees? Did the young trees grow from seed or by sprouting from the old stumps or roots? Are brush species rather than tree species taking over the site? It would be best to view a logging site which is one or more years old to determine the answers to these questions.

*Wildlife*

Is wildlife evident in the logging area? What species? If deer are present, what do they eat? Observe the logging debris and young growth if present. Does a cutover area offer more or less food than a mature forest?

*Products of Trees*

What products are being harvested from the area? What are other possible products which might be cut from the trees? Is the whole tree utilized? If not, how much is discarded? Is the discarded portion rotten, crooked, or small in size? Are all species of trees utilized? Where are the products used or sold?

*Impact of Forest Industries on Local Economy*

How many people in your area make all or part of their living from logging? Are there any local sawmills, pulp and paper mills or other forest industries?

Determination of Size, Age and Growth of a Tree

*Materials List*

Increment Borer or Bow Saw
Instrument to Measure Height (optional)
Measuring Tape
Pencil and Paper

Purpose: Determine height and age of trees. The ratio of height to age gives an indication of a tree's rate of growth. Diameters of trees can also be determined for comparison to age. Age level — grades 7 through 12.

*Measuring Height*

Height can be measured with instruments made for that purpose if available. If not, use the following method: With a pencil or stick, sight at a person of known height standing beside the tree. The pencil tip should coincide with his head and the finger of the pencil holder should mark the point on the pencil that coincides with the person's feet. Moving up the tree, count the number of pencil lengths to the top of the tree. Number of Pencil Lengths (4½) × Person's Height (6′) = Tree Height (27′).

*Determining Age*

Use an increment borer if available. Bore the tree to the center at breast height (4.5 feet). Count the growth rings and add five (average figure) for the difference from ground level to breast height to determine age.

If an increment borer is not available and trees can be cut down, saw the tree off as close to ground level as possible and count the growth rings.

Compare the tree height to age. Generally speaking, a growth rate of one foot per year is average. A higher figure would be better than average and a lower figure would be less than desirable.

It might also be interesting to compare diameter to age. If the tree is cut down, the diameter can be easily measured. If the tree is not cut down, measure the circumference and divide by "Pi" to determine the diameter.

$$\text{Diameter} = \frac{\text{Circumference}}{3.14}$$

*Conclusion*

The ratio of height to age is the most important indication of the suitability of the site for a tree species. Factors in a poor site may include insufficient or excessive drainage, wrong type of soil, low soil fertility, poor aspect or exposure (insufficient or excessive sunlight), etc. Other factors in poor height growth may include disease, adverse weather conditions and animal damage.

Diameter growth is dependent on the same factors. However, poor diameter growth may result on a very good site because of overcrowding or high density of trees. Diameter growth is not a good indication of site suitability.

Site requirements differ for various species of trees. Aspen, for example, will generally do rather poorly on a jack pine site. Thus, a poor site index for some species does not necessarily indicate that the site is unsuitable for all species. If several species of trees are present on your area, check them to compare the site indexes.

Boring tree with increment bore to determine age.

**Bibliography**

*Division of Lands & Forestry Training Manuals*, Minnesota Department of Natural Resources. Contact any Division of Lands and Forestry field office.

*The American Forestry Series*, McGraw-Hill Book Co., Inc., New York.

# HOW TO BUILD A COMPOST PILE

The volume of solid wastes discarded by Minnesotans has reached staggering proportions. Here's what YOU can do about it, in your own back yard.

Compiled by the Carver Park Nature Center Staff

We live in a cluttered world. At this time, about 1,100 landfills are operated for disposal of refuse and about 98 percent of these are open dumps that do not conform to existing regulations.

Our waste disposal problems are most critical in our urban centers, especially in our Twin City metropolitan area. According to a recent report about one million tons of solid wastes were generated in the Seven-County metro area in 1968. And surprisingly, 70 percent of these were domestic wastes.

This refuse, equivalent to 3.2 pounds per person per day, could be significantly reduced if more persons would recycle solid wastes by starting compost piles near their gardens or behind some trees or buildings in their backyards.

Composting is certainly more desirable than burning which contributes to air pollution, or sink garbage disposal which is a water pollution problem.

A variety of ingredients can be mixed into a compost pile — leaves, vegetable wastes from your kitchen, shredded paper and rags, grass clippings, sawdust, garden wastes, weeds, sewage, sludge, brewery and cannery wastes, hay, nutshells, coffee grounds, dried blood, manure, straw, soil, etc.

Bones or other animal wastes may attract rodents so bury them deeply or eliminate from your pile. Eggshells and ashes are good but not in large quantities as they may add too much salt or alkalinity.

Mix these together or spread in thin alternating layers.

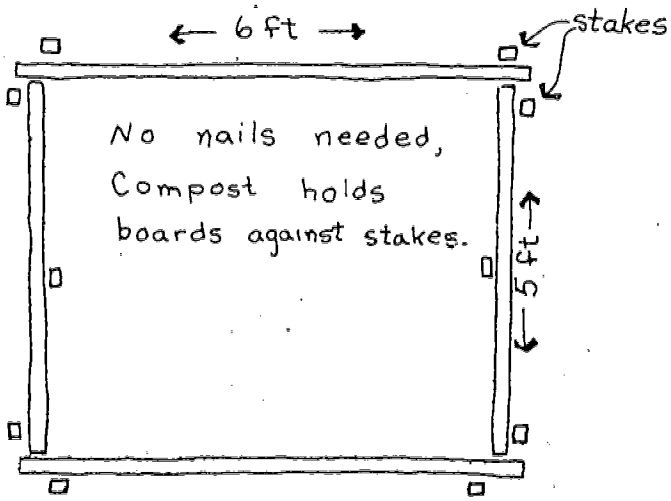
Mix in some soil or finished compost. Rich things such as dried blood and manure make it decay faster. Keep the pile moist but not soggy. Water it about once a week in dry weather. This will help the compost "work" faster.

"Turn" or move your pile every couple of weeks, or when it is getting too hot in the center. Take the top part of the pile and put it on the bottom, then reverse the process. This prevents spontaneous combustion from starting as a result of the accumulated heat of decomposition in the pile's center, and also helps the compost to decompose evenly.

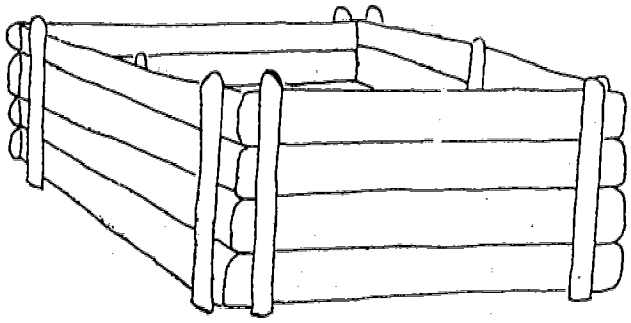
You can also put your wastes in a ventilated bin. (5 feet x 5 feet x 5 feet) is a good size. This method may eliminate turning and also keeps wastes from being scattered in any way. Keep the pile covered with soil to prevent odor. Some soil mixed into the organic matter helps it to decompose since it contains decomposing bacteria.

When your pile is big enough — from three to six feet high — stop adding to it (start a second pile), continue turning it when necessary, and wait until it is well decomposed and is no longer noticeably warm in the center — two or three months. Then it is ready to use as a soil conditioner, fertilizer, or mulch in your garden.

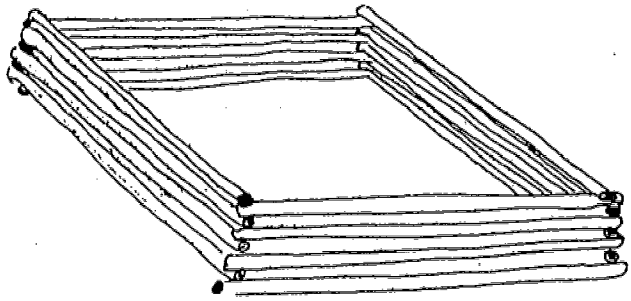
# COMPOST BINS



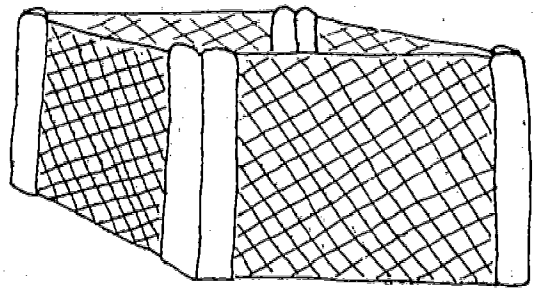

① Top View



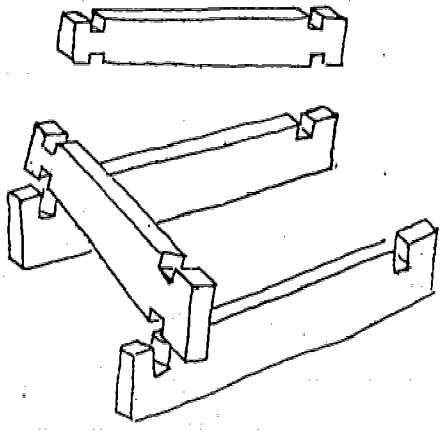
① Side View



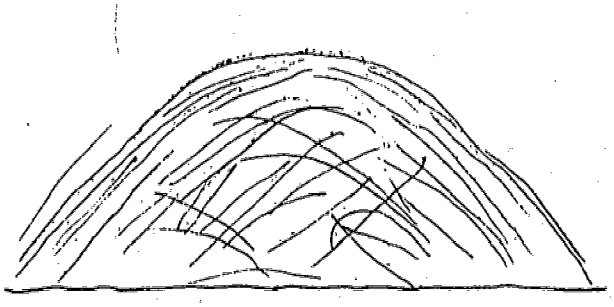
② Nailed logs with 1 inch air spaces for ventilation.



③ Wire mesh stapled To corner posts - provides good ventilation.



④ Notched, interlocking boards.



⑤ Or, just throw it all in a big pile.

Planting trees or shrubs on your school grounds is an excellent activity.

# ENVIRONMENTAL ACTION ACTIVITIES

By Kathlyn Heidel
*Naturalist at Carver Nature Center*

Let's not forget the meaning of Earth Day! Develop with children (and their parents), a list of environmental action measures they can work on as a group. These activities (some suggestions follow) are often hard work but high group spirit can make them fun — and you are doing your Earth a service.

1. Clean up an area or street, lake, or stream bank of litter. Thoughtfully consider the best way to dispose of it, or conduct a paper or metal can drive in your community.
2. Consult the local highway office for consent and support to plant a cover crop such as grass, clover,

**Here's A List of Action Projects for Your Class**

trees, bushes on the sides of a new highway cut. Explain your plans to the merchants who sell such seed or plants and see if you can get donations. If you plant seeds, be sure to cover with cut straw or similar material so rain doesn't wash them away.

3. Try to secure 50-gallon drums with tops cut off or ask local merchants for free or extra low priced trash (garbage) cans. Paint them bright colors and letter on slogans such as: TRASH, Put Your Trash Here, Garbage Can, Help Feed the Hungry Garbage Can! Contact local authorities with ideas or ask for suggestions for placement of the cans. Arrange for disposal of the trash once the can is filled.
4. Make a camp or neighborhood map. Plot watershed, flood plains if any, pollution sources, sites of dwellings, roads, etc. Study carefully. Make recommendations as to where to erect new homes, cabins, or tents, where to dispose of liquid wastes so they don't return to your water source or affect anyone else's water source, where to lay future paths or roads. If existing paths are placed poorly in relationship to the watershed, make a new routing plan. Try to correct mistakes in relation to your camp or home environment.
5. Plant a window garden, or an outdoor box or plot in a yard (vegetables or flowers, whatever you like). Plan to care for it regularly. Or, plant a tree. Consult your city park board to see if you can help turn a barren area into a green, oxygen-producing beauty spot such as a community flower garden.
6. To reduce the use of herbicides by lawnowners, plan a progressive weed removal program on your lawns or in a block or neighborhood. Plan with owners what weeds they want removed and the correct time to do it. Have the youngsters wear grubby clothes and bring gloves, dandelion diggers or dull knives to do the job. Compost the weeds.
7. Conduct a door to door campaign requesting that people not use high phosphate detergents (phosphates fertilize algae and lake vegetation making the green scum that borders our lakes and rivers). Urge people to read up on phosphate contents of our detergents.
8. Conduct an Environmental Scavenger Hunt or a Pollution Track-Down to locate local polluters and visible sources of pollution. Call public attention to the situation. Present your information, disapproval or protest to the polluter(s), and/or local, state, or federal regulatory agency and request corrective measures to be taken.
9. Request people in your neighborhood or community to save used cooking fats and grease. Plan collection dates. Then make homemade soap for use in your homes or to sell. Here is the recipe: Heat 3 quarts of melted fat to lukewarm and strain. This is about 5 lbs. 2 oz. Use bacon drippings, clarified meat scraps, lard, etc. Dissolve one can of lye in one quart of cold water. When it heats up to lukewarm, stir fat into it and immediately add one cup of ammonia and 2 tablespoons of borax which have been dissolved in one half cup of warm water. One teaspoon of citronella may be added. Allow mixture to cool. It will harden, and may be cut up into cakes, or flaked for soap solution from Gardening without Poisons by Beatrice T. Hunter, Houghton Mifflin Company, publisher.

Conduct a Pollution Track-Down. Locate visible sources of pollution. Then, call public attention to situation.

# NATURE ACTIVITIES

Prepared by Carver Park Nature Center

On one of your "outdoor" hikes, conduct a Nature Hunt in which the five senses are used. Nothing is collected. Items are checked off on your list only when they have been seen, smelled, tasted, touched or heard.

Place youngsters in small groups and have each group devise their own Nature Hunt check-sheet. Exchange sheets with other groups and try it again or on a later hike.

Make tincan star scopes — one or two constellations per scope — and learn to recognize certain star patterns. Then some evening go outside and have a star gazing session.

**Some things to do on a hike, field trip or during a regular meeting.**

Construct a terrarium using a wide-mouth gallon jar (try scrounging the pickle jars from restaurants) or use some other suitable glass container. Plant it with woodland plants, ferns, mosses, etc. — or plant it with grass and other common backyard plants and add crickets, grasshoppers, worms, etc., to make an insect zoo. Or — place the plants in a dish or planter to make a "Dish Garden." Water. They make lovely centerpieces.

Put together a simple musical instrument using materials you find out-of-doors (reeds, bark, leaves, stems, shells, etc. — don't denude the country-side collecting, though). Try playing them or composing some original music for them.

Night or After-Dark Hikes can be great fun. Be aware of sounds. Try with stealth and flashlights to see what makes the sounds. In a forest try to see the earthworms pulling bits and pieces of leaves into their holes. Try to catch a shrew scurrying about in search of insects or other meat. (Catch it with your eyes only!)

Seal a lighted flashlight in a glass jar and lower into a pond or stream to see what goes on under water at night. Listen for frogs and try to spot them with your light. Listen under water at night. Listen for owls. Search for various stars and constellations. Try some night-time photography.

Do an involvement activity. "You Be The Naturalist." Choose a specific area or length of trail. Assign each child to a point in that area and allow each five minutes to formulate a question to ask the rest of the group.

Questions should be designed to encourage real observation, thinking, and discussion. They should not be questions which ask for names or yes or no answers. An answer need not be given or known. When all have formulated their questions, gather the group together at one youth's point. Let that person be the leader and stimulate discussion. Then move on to each youth in turn until all have had a chance to be the naturalist.

"Where Are The Animals?" Record on a data sheet the animals and where you find them in the various levels of a plant community. Conducting this activity on a competition basis often yields better results. Girls should be working in small groups of 2, 3, or 4.

"Habitat Activity." Explore, again in small groups, the habitat of a plant and/or animal in detail. Name, sketch, or describe the animal or plant and proceed to list all other living and non-living things which may share that same habitat.

In winter, make "track cards" which show the tracks of various animals. Go for a walk in the snow and see how many tracks you can identify. Where was the animal going? Where did it come from? Was it doing anything special here? — e.g. squirrel eating, etc.

*(See illustrations on page 28)*

## NATURE HUNT CHECK LIST

### THINGS TO SEE
- ☐ A rounded stone (Put it back)
- ☐ Moss on the *south* side of a tree
- ☐ A woodtick
- ☐ A cocoon (leave it there)
- ☐ A red and black bird
- ☐ A milkweed pod
- ☐ An orange butterfly
- ☐ A bird's nest (Don't touch!)
- ☐ A cloud moving
- ☐ A cattail

### THINGS TO HEAR
- ☐ A mosquito buzzing
- ☐ Wind blowing through the field
- ☐ Something jumping into the water
- ☐ Chipping sound of a chipmunk
- ☐ Dry leaves under your feet

### THINGS TO SMELL
- ☐ Inside a hollow log
- ☐ A garter snake (Handle carefully)
- ☐ Crushed green grass
- ☐ Crushed dry leaves
- ☐ 2 Kinds of flowers (Don't pick them!)
- ☐ Water in a marsh

### THINGS TO FEEL
- ☐ Rotten wood
- ☐ A mushroom
- ☐ A fuzzy plant
- ☐ A thistle
- ☐ Wet mud
- ☐ Dry soil
- ☐ A mosquito bite
- ☐ Shade
- ☐ An animal's leg moving (No mammals)
- ☐ A turtle shell
- ☐ A feather tickling

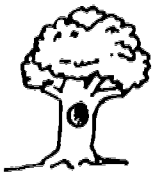
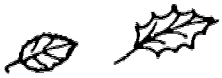
### THINGS HAPPENING (JUST WATCH. DON'T DISTURB)
- ☐ An ant carrying something
- ☐ A mushroom growing on a log
- ☐ An animal trail
- ☐ A seed traveling
- ☐ A grasshopper jumping
- ☐ An animal eating another animal
- ☐ A spider web with a bug in it
- ☐ A plant growing *on* a rock

Name_____

Date_____

# NATURE HUNT

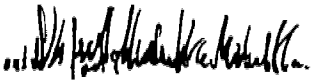
## THINGS TO SEE

- ☐ A feather 
- ☐ A hole in a tree 
- ☐ A yellow leaf 
- ☐ A red & black bird 
- ☐ An ant 
- ☐ A woodtick 
- ☐ A butterfly 

## THINGS TO HEAR

- ☐ A bee 
- ☐ Trees in the wind 
- ☐ A duck 
- ☐ Dry leaves under feet 
- ☐ A chipmunk 

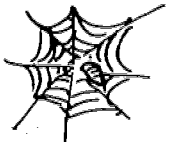
## THINGS TO SMELL

- ☐ The mud 
- ☐ A yellow flower 
- ☐ A burrow 
- ☐ Green grass 
- ☐ Old leaves 

## THINGS TO FEEL

- ☐ Wet mud 
- ☐ Prickly plant 
- ☐ The wind on a hill 
- ☐ A mosquito bite 
- ☐ Rotten wood 
- ☐ Tree bark 

## THINGS HAPPENING

- ☐ An ant moving something 
- ☐ A spiderweb with a bug in it 
- ☐ A leaf falling 
- ☐ An animal eating 
- ☐ A turtle swimming 
- ☐ A frog jumping 

Name_____

Date_____

# GOING SOMEWHERE?

By Kathlyn Heidel
Carver Park Nature Center

- Find out what natural resources are in your immediate locality. Visit one of these areas, such as a stone quarry, waterfall, river, creek, marsh, farm (soil), etc., to learn more about the values and use of the natural resource. Make a list of things you want to find out before you go.
- Arrange to visit the water reservoir which serves your community. Find out where the water comes from (well, river, lake, etc.) and what steps are taken to prepare it for household use.
- Visit the local Sewage Treatment Plant. Are the contents of storm sewers also treated here? Is the treatment primary, secondary, or better yet, tertiary? Where and in what condition is the effluent finally discharged? Relate this to pollution in your own environment.
- Take a trip to the zoo with a definite purpose in mind. Observe the animals' method of travel, adaptations for eating, moving, drinking and making sounds. From these adaptations, try to determine the animals' natural habitats.
- Plan a tour of the Bell Museum of Natural History in Minneapolis or the Science Museum in St. Paul. Ask for a guided tour or do your own "questioning" interpretation at various dioramas.
- Visit the Eloise Butler Flower Garden in Theodore Wirth Park in Minneapolis. Notice what flowers are blooming. How are the flowers being pollinated? What type of habitat are they in, etc.?
- Take a trip to a florist. Try to learn something about some of the plants, e.g. what country or part of the world they come from, climate they grow in, how they must be cared for, how transported to here, etc.
- Visit a United States Weather Station. Before you go, make a list of questions to ask the weatherman.
- Go on a neighborhood hike. Have a definite purpose in mind:

  Look for animals, both tame and wild. Find out what they are eating, where they find shelter, their means of protection, who are their enemies, how people affect them, etc.

  Observe tree shapes. Try photographing them.

  Look at flowers. What flowers do people plant and where? Which flowers grow wild? Are there any tree or shrub flowers to see? Have a flower popularity contest: Which one is the prettiest? Which one smells best? Which one is most popular with insects?

  Have a bird hike. Look for birds to see colors and shapes. Try to find nests without walking up to them. Watch a bird at its nest for awhile to note its behavior.
- Take a city hike to find different kinds of wood and stone used in buildings. Observe sidewalk cracks for animal and plant life. What sounds do you hear? Manmade? Natural? What smells are there in different places? Where do the smells come from? What birds nest in a city? Where? Pick up trash and try to determine what natural resources it was made from. Where does the water go when it rains in this place, etc.
- A series of hikes, in any locality, might be planned with various discovery themes; progressing from very simple to more involved. You might want to go to a Nature Center, but with all these ideas you certainly don't need a naturalist. Try doing your own interpretation.

Visit your city dump to gain a lasting awareness of what we are doing with and to our natural resources.

**Discovery Themes:**

Just observing and exploring — for animals, their homes, food; for different kinds of trees; plants; etc.

Hunting with all your senses (take it easy on taste). Don't tell your youngsters anything. Have them feel things to discover if they're slippery, smooth, sharp, cool, wet, hairy, rough. Feel soil, leaves, water, stones, stems, frogs, snakes, wind, pricker plants, etc. (Do watch out for poison ivy if there is any in the area). Smell different things — leaves, flowers, animal holes, wet soil, water, etc.

Look for colors, shades, shapes, sizes of insects, etc. Can you find a stump or knot in a tree that looks like a face, a cloud that looks like an animal, a woodpecker hotel, etc. Close your eyes and mouth and listen to the wind, different birds, insects, leaves blowing, grass moving, rain falling, water rippling and whispering, etc.

Hunt for happenings. Look for something changing, moving, building a home, becoming food for something else, carrying something, dying, growing, rotting, eating, etc.

- Take a hike to a rural area or to abandoned farm land and look for indicators of man's influence on the rural landscape.

*Straight Lines*
A. Old Fence Line
B. Cut Stump
C. Drainage Ditch

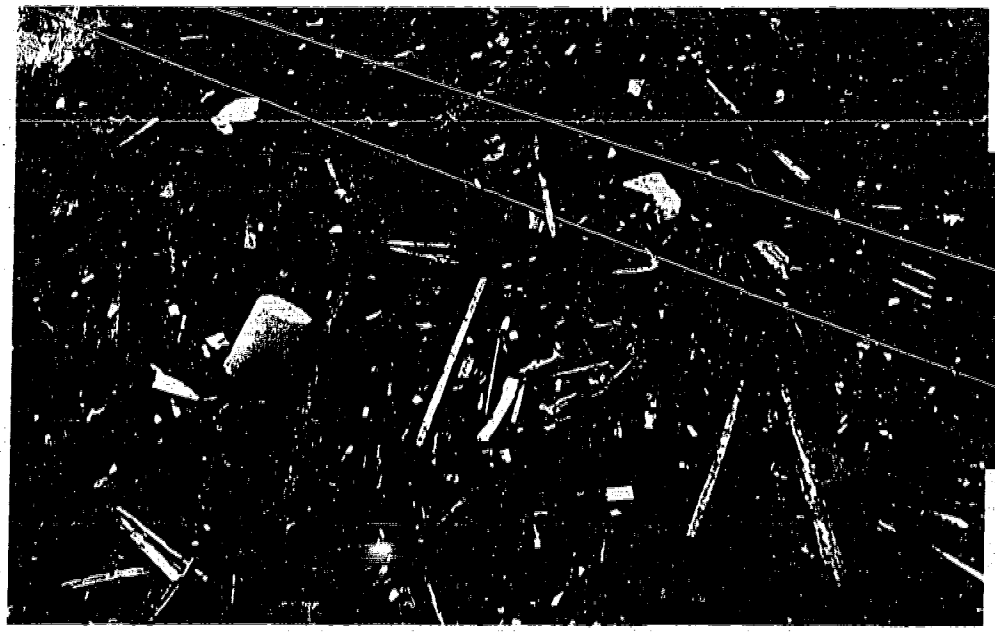
*Moved Earth*
A. Dams
B. Railroad Grades
C. Nesting Islands
D. Doughnut Ponds

*Old Farm Yards*
A. Foundations
B. Landscape Plantings
C. Windbreaks

*Old Fields*
A. Field Stone Piles
B. Tractor Trails
C. Erosion — Gullies, etc.
D. Cleared of Trees

*Structures*
A. Power and Phone Lines
B. Signs
C. Wells

*Garbage*
A. Bottles and Cans
B. Old Car and Truck Parts



THIS?

Or THIS?

# DEPENDS ON YOU